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54 Control unit for intracanal hearing aids.

57 Improvement in the closure plate and control unit of hearing aids to be inserted into the auditory meatus of the hard of hearing, also called intracanal hearing aids, characterized by an extremely reduced size, which unit is housed in an opening of the closure plate and fastened therein by means of rotating ratchet members; the unit is so shaped as to receive only a portion of the battery, namely the

central portion, while the polar portions thereof are received in the opening formed in the closure plate; this shape makes it possible a further reduction in the size of the unit, the circular small cover thereof resting and being supported by the edge of the opening housing the unit rather than by portions of the body of said unit, thereby operating also as a cover for said opening.

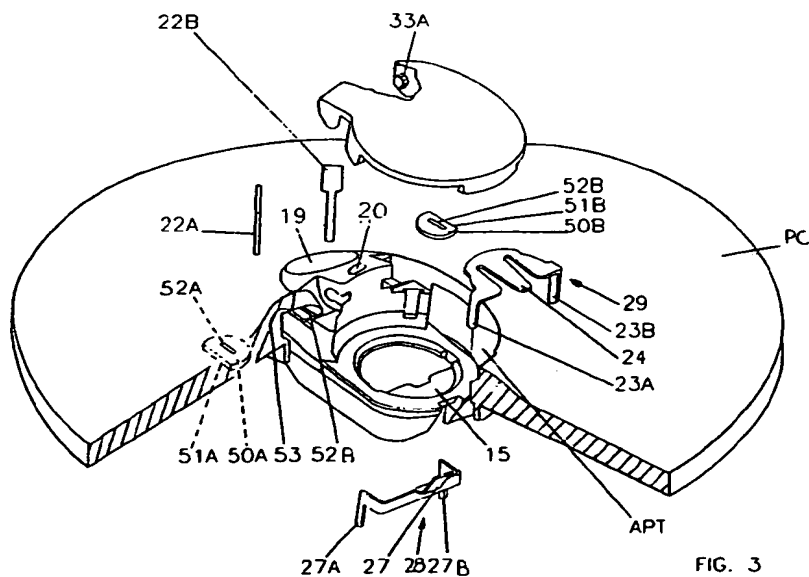


FIG. 3

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This invention relates to an improvement in the closure plate and control unit of hearing aids which are located inside the auditory meatus of people who are hard of hearing, also called intracanal hearing aids.

As it is already known by the experts in the art, in the last years hearing aids apparatuses for people with hearing problems have met with a radical transformation which regarded first the position of the apparatus. At first the apparatus was placed in a specially made spectacles ear-piece, later it was located behind the pinna, not completely hidden from sight, and finally it was located inside the auditory meatus, in a position in which it is practically invisible.

The apparatuses internal to the auditory meatus, or intracanal apparatuses, have then undergone a greater and greater miniaturization tending to make them less and less visible.

This kind of apparatuses comprises a generally cone-shaped hollow body, moulded with well-known techniques to the internal shape of the auditory meatus of the person for whom the hearing aid is intended, a closure plate for the opening of said hollow body and a control unit usually provided with an opening for the microphone, a cavity for the volume control potentiometer and a seat for the battery supplying the electronic circuits of amplification. In the seat for the battery, closed by a proper small cover, are then contained the contacts whereby the power produced by the battery is carried. These contacts function also as an ON-OFF switch according to the position of the small cover which controls the position of the battery with regard to said contacts, acting resiliently on the battery.

With regard to this subject, the applicant has already devised, realized and patented various control units that are very reduced in size, and still contain and display their component members in the best way and perform all their functions perfectly.

Through this application the applicant aims at providing an even smaller control unit housed inside an opening in the closure plate and fixed to the plate by means of rotating ratchet members. Unlike the units which have been employed up to now, the unit according to the invention is so shaped and structured as to house only a portion of the battery, namely the central portion, while both "polar" portions thereof are located in the above-mentioned cylindrical opening on the closure plate, which has the right size to receive the so-called "button" battery usually employed in this kind of hearing aids. This structure, besides permitting a further reduction in the size of the unit, reduces the complexity of the latter as well, making it easier the moulding thereof. Indeed, the abutting

surface against which the small cover of the unit rests, and by which it is supported, corresponds to the edge of the opening housing the unit, so that said small cover functions also as a closure both for the unit and the battery.

In the unit seat there are also contained the contacts for programming the amplification circuits with regard to the tone. Owing to this arrangement, to effect the above-mentioned programming it will be sufficient to open the small cover and connect the programming computer to the internal circuit through the above-mentioned contacts.

Finally, besides operating as an ON-OFF switch, the small cover, as already mentioned, is also used as a grip for the fingers, in order to facilitate the insertion in place and removal of the hearing aid. When partially open, the small cover can be removed from the unit thanks to the prismatic shape of the pivot pins which, in said position, can be removed from their seats.

The invention will be now described in full detail with reference to the annexed drawings, wherein:

Fig.1 is a view of the control unit according to the invention, inserted in the closure plate of the hearing aid, the small cover being closed;

Fig.2 is a similar view of the control unit with the small cover open;

Fig.3 is an exploded perspective view of the control unit inserted in the closure plate, that has been partially sectioned along two lines forming an angle of 90°;

Fig.4 is an exploded perspective view of the control unit, only;

Fig.5 is a similar view of the control unit with some of the component members inserted in their place;

Fig.6 is a diametral section of the closure plate and the control unit cut along the major axis of the latter, with half of the plate omitted;

Fig.7 is a side view of the closure plate and control unit with the small cover closed;

Fig.8 is a diametral section of the closure plate and control unit with the small cover open and the battery inserted, in the OFF position of the hearing aid; and

Fig.9 is a similar section of the closure plate with the small cover completely open (position of insertion and removal of the hearing aid).

Referring first to Figs. 1, 2, 3 and 5, control unit MC (represented in exploded view in Fig.5) comprises a lower holding element 10 and a small cover 30. This unit is intended to be received inside an opening APT on closure plate PC of the body of hearing aid TSI, which body is represented in dashed lines in Figs. 7, 8 and 9. Closure plate PC has a lenticular shape the thicker portion of which corresponds to opening APT (Fig.6). Lower

element 10 has a section 11 overhung by a "castle-shaped" portion 12 provided with a face 13, shaped like a cylinder portion, having a rounded lower section, as referred to by 14. At the base of lower section 14 of face 13 a closed bottom circular seat 15 is formed, provided with an inclined section opposite to face 13.

Upper section of castle-shaped portion 12 gets narrower on both sides, as referred to by 18A and 18B, and presents a seat 19 on the top, for housing potentiometer PZ, and an opening 20 for the microphone, as is usual with regard to intracanal hearing aids.

In narrow portions 18A, 18B, as it will be better described afterwards, the seats for pivot pins 31A, 31B of small cover 30 are located. The prismatic section of pivot pins 31A, 31B permits their engagement and disengagement from the above-mentioned seats.

In the lateral sections of cylindrical face 13, in correspondence with narrowings 18A, 18B, two slot openings 21A, 21B are formed, which extend downward. In each opening 21A, 21B a laminated contact 22A, 22B is housed, which contacts 22A, 22B, as previously mentioned, are used for the connection to the computer in order to program the computerized amplification circuit with regard to the tone.

In circular seat 15 there has been housed a trident-shaped contact 23 for the negative pole of battery BT. The lateral portions of contact 23 are provided with two extensions 23A, 23B, directed downward. Resilient central finger 24 of contact 23 is slightly raised so as to exert an upward resilient bias on the battery which rests thereon. Lateral extensions 23 (A, B) find their housing in matching grooves 25A, 25B, opening downwards and located in two opposite portions of circular seat 15.

In the middle of external face of portion 11 a rather large groove or slot 26 is provided, intended to receive central tongue 27 of contact 28 for the positive pole of battery BT. Contact 28 is provided with two extensions 27A, 27B, directed downward.

Control unit MC, according to the invention, is provided with fastening elements intended to operate concurrently with their matching portions formed in opening APT of closure plate PC in order to fix the unit in the full inserted position.

Said fastening elements comprise two round washers 50A, 50B (Figs. 3, 4, 9) each having a cut off portion 51A, 51B and a diametral slit 52A, 52B that is parallel to the edge of the respective cut off portion.

Each washer rests on a plane seat 28A, 28B formed on castle-shaped portion 12, below the seats of pivot pins 31A, 31B of small cover 30. Plane seats 28A, 28B extend on both sides with a "cut" 29A formed in body of castle-shaped portion

12, being each washer inserted in said cut (Fig.4).

When control unit MC is inserted inside opening APT of closure plate PC, plane seats 28A, 28B are level with a corresponding step 53 which has been formed in opening APT, so that each washer 50A, 50B, inserted in cut 29A and rotating on the respective plane seat 28A, 28B, can engage under said step. Round washers 50A, 50B are so shaped as they do not prevent the insertion of control unit MC in opening APT when cut off portions 51A, 51B correspond with straight cuts 29C, 29D of plane seats 28A, 28B (Fig.4). In order to fasten control unit MC in place, washers 50A, 50B are rotated by an angle of 180° by means of a small screwdriver inserted in slits 52A, 52B so as to bring their round-shaped portions to project from corresponding straight cuts 29C, 29D. In this position washers 50A, 50B engage under step 53, thereby locking control unit MC inside opening APT.

As previously mentioned, small cover 30 is joined to castle-shaped portion 12 by means of prismatic pivot pins 31A, 31B thereof, which are received in their relative seats, similarly shaped and formed in portions 18A, 18B.

Small cover 30 has an essentially circular flat portion 38 presenting a cut off section 32 which forms two facing lugs 33A, 33B. A corresponding pivot pin 31A, 31B projects from each lug 33A, 33B.

From circular portion 38 two lateral ribs, referred to by 34A, 34B, and a front jut 35 with a crowned rim 36 project downward. Above front jut 35, on circular portion 38, a bevel cut 37 has been formed, in order to make it easier to lift small cover 30 with a fingernail.

On inner edge of opening APT, in correspondence with crowned rim 36, a shallow cavity 39 is formed wherein crowned rim 36 snaps when in the closed-cover position (Fig.8).

As previously mentioned, when battery BT (Figs. 8 and 9) is inserted in both circular seat 15 and opening APT of closure plate PC, its negative pole rests against resilient finger 24 of contact 23, which keeps battery BT raised and separated from central tongue 27, intended for the connection with positive pole; by closing small cover 30, battery BT is pushed against central tongue 27, causing a current feed to the internal circuits, connected to lateral extensions 23(A, B) for negative pole and with extensions 27(A, B) for positive pole of the hearing aid (omitted). The hearing aid is thereby brought to the ON position. A partial opening of small cover 30 will cause battery BT to lift, thereby interrupting the power supply and bringing the hearing aid to the OFF position. Finally, by completely lifting small cover 30 (Fig.9) it will be possible to grip the same with the fingers in order to position the hearing aid. The matching shape of

prismatic pivot pins 31(A, B) and their seats 45 (Figs. 4 and 5) determines the various steady positions of small cover 30.

Now it should be mentioned once more that the characteristic feature which distinguishes the present invention from control units of the previous technique, is that the elongated body of the unit houses only the central portion of the battery, while the polar sections thereof project from open sides 48 of castle-shaped portion 12 and portion 11 to be received in circular opening APT of closure plate PC.

In the light of what has been previously said it will have been noticed that the invention provides a control unit for intracanal hearing aids which is characterized by an extremely reduced size, an easy moulding process and a great efficiency that is not possible to find in the units presently available.

#### Claims

1. A control unit for intracanal hearing aids intended to be inserted into the auditory meatus of the hard of hearing and comprising a generally cone-shaped hollow body moulded to the internal shape of said meatus, said hollow body housing the circuits of amplification of the hearing aid and the earphone, and a closure plate for said hollow body having a circular opening intended to house said control unit, said control unit containing the battery with the relative contacts, the relative position whereof determines the condition ON and/or OFF of the hearing aid, and being said control unit provided with a small circular cover pushing the battery against said contacts when in the closed position, and characterized in that the body of said unit is elongated in the shape of a hull, that said small circular cover closes said circular opening of said closure plate by resting against the edge of said opening, wherein it snaps in the closed position by means of matching projecting and indented members, that said battery is housed partially in said opening of the closure plate and partially in a seat obtained in the elongated body of said unit and that the unit, when inserted in said opening, is fastened therein by means of fastening ratchet members which can be put into operation from the outside when said small cover is open.
2. The control unit of claim 1, wherein said jutting and indented members comprise a crowned rim formed on said small cover and a shallow cavity formed on the corresponding portion of the inner edge of said opening.
3. The control unit of claim 1, wherein the body of said unit is open on two opposite sides in order to make it possible the insertion of the cylindrical battery in the relative elongated central seat.
4. The control module of claim 1, wherein said fastening ratchet members comprise two essentially circular washers having a straight edge cut off section and a central slit and resting on a circular plane seat having a straight section along the edge and extending with a thin groove intended to receive the rim of the respective washer, and a step formed in said opening of the closure plate, said washers permitting the insertion and removal of said unit with regard to said opening when said cut off section corresponds with said straight section of said seat and preventing said insertion and removal when their round shaped edge projects from said straight section on the edge of said seat thereby engaging under said step, being said washers rotated by means of a screwdriver inserted in said central slits.

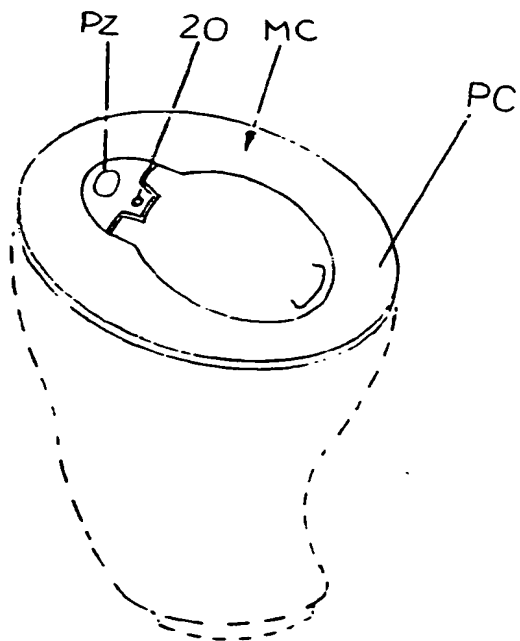


FIG. 1

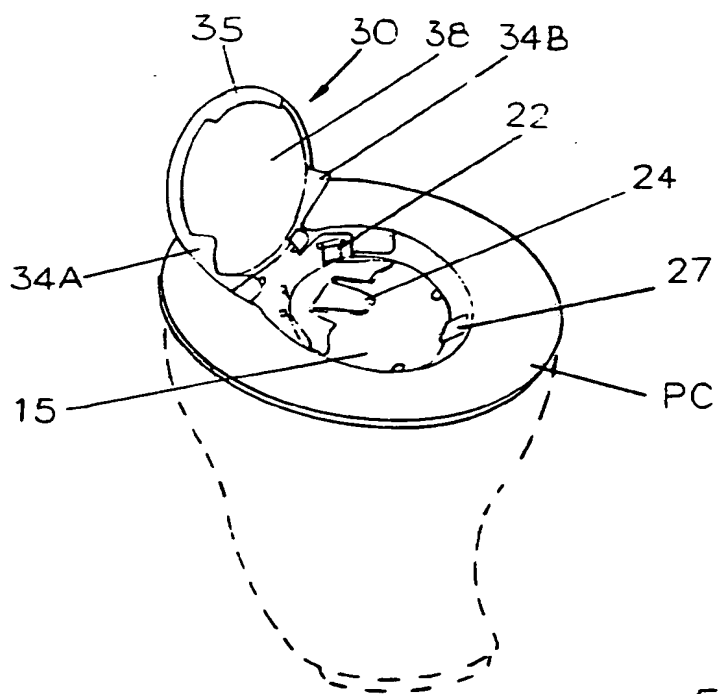
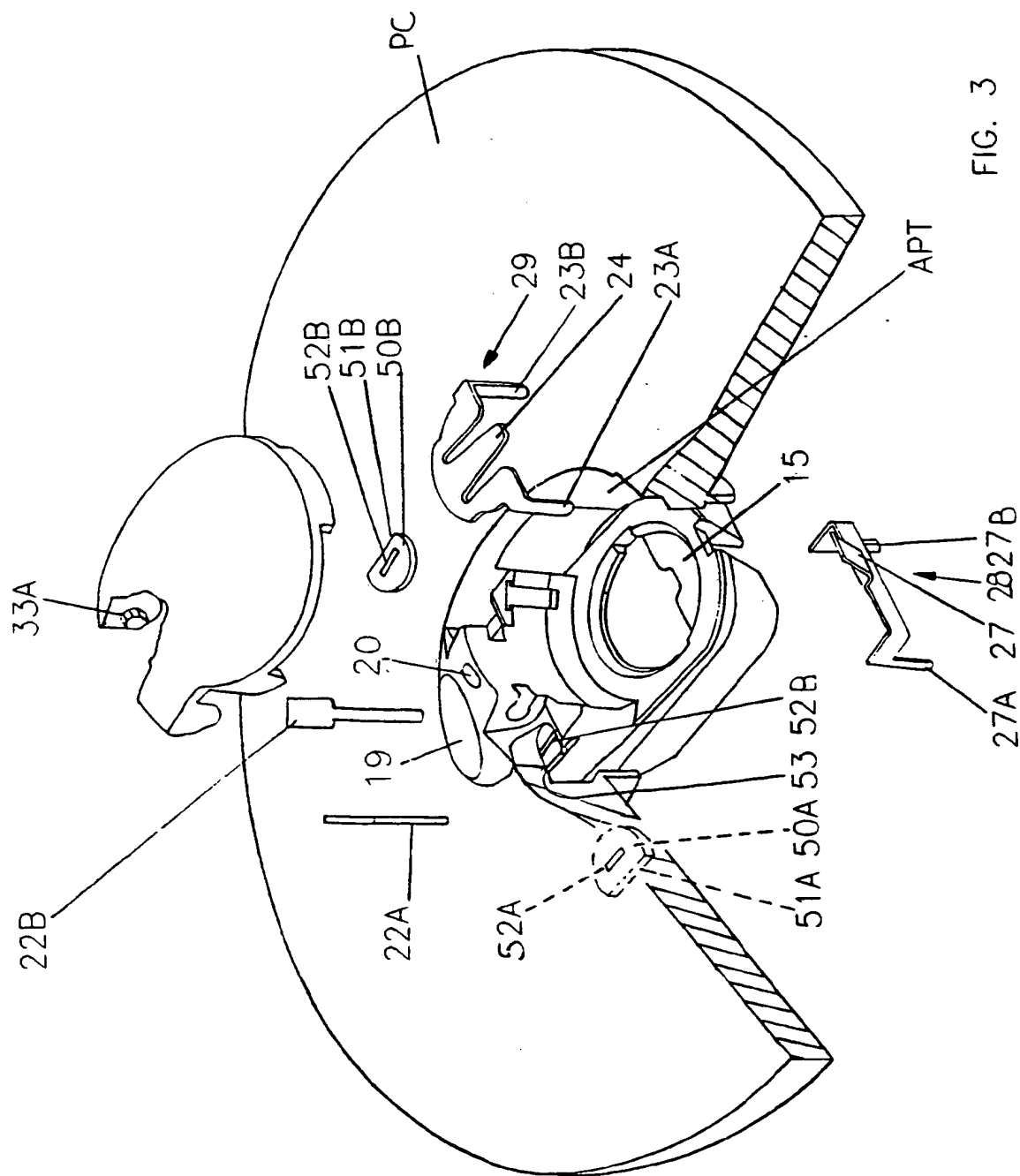


FIG. 2



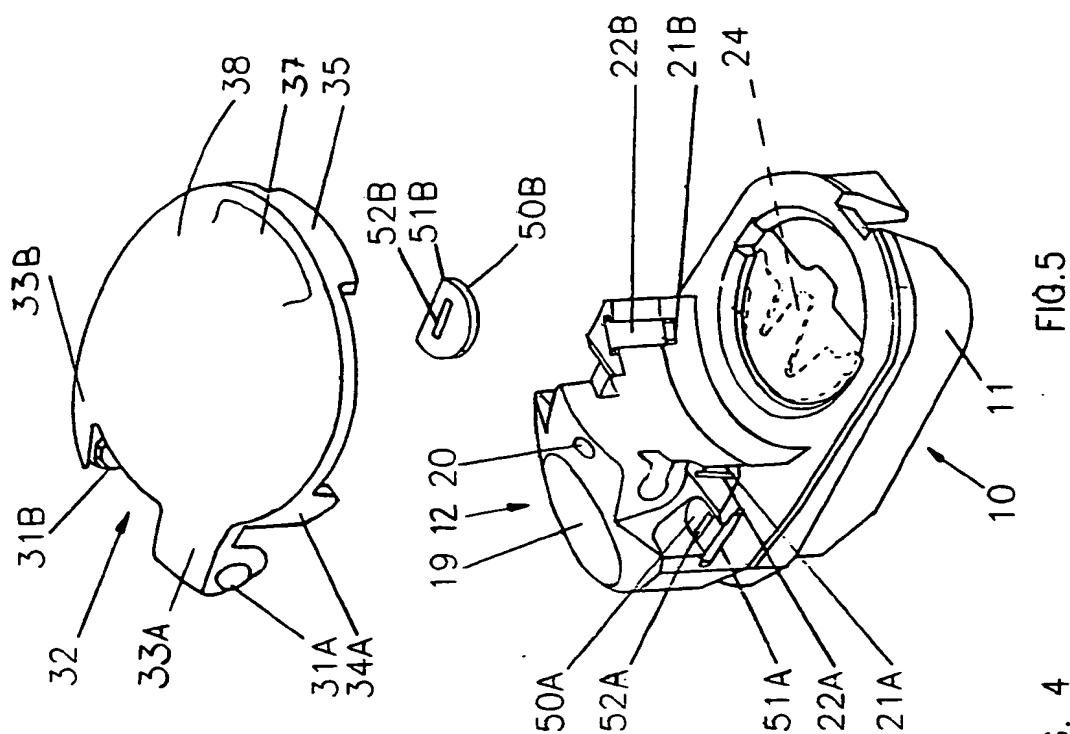


FIG. 5

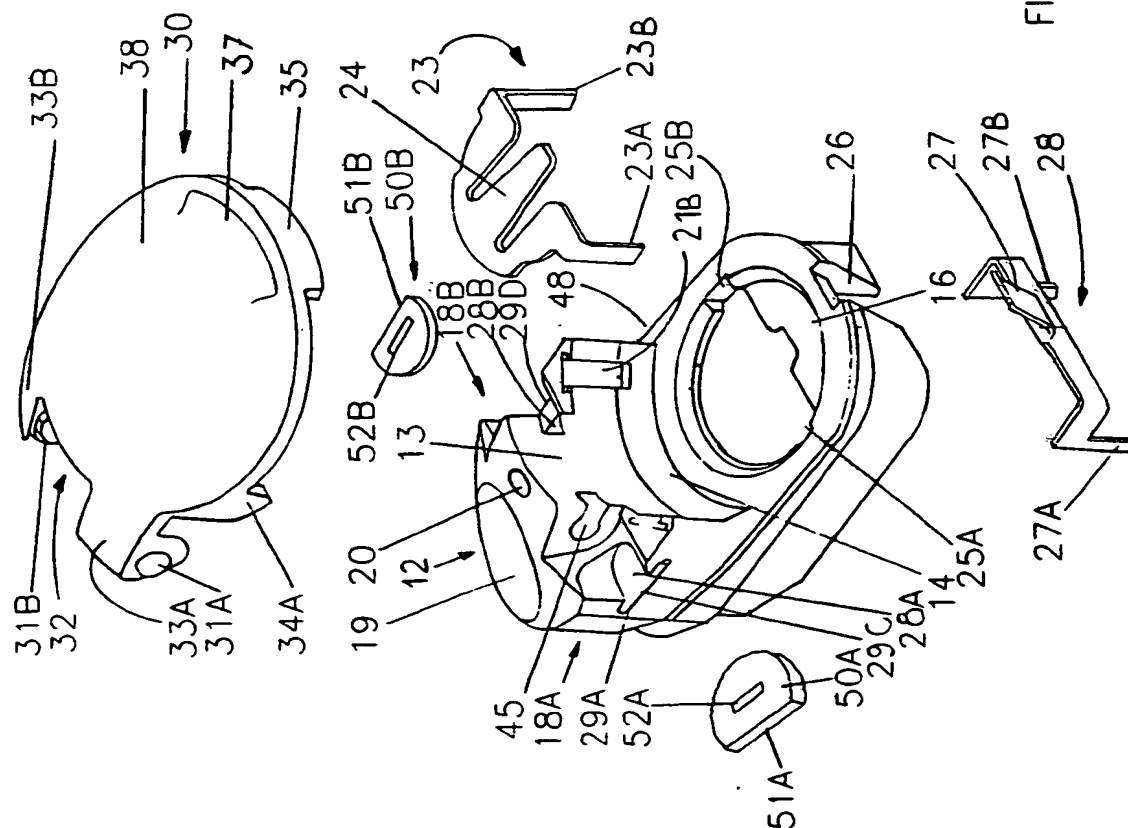


FIG. 4

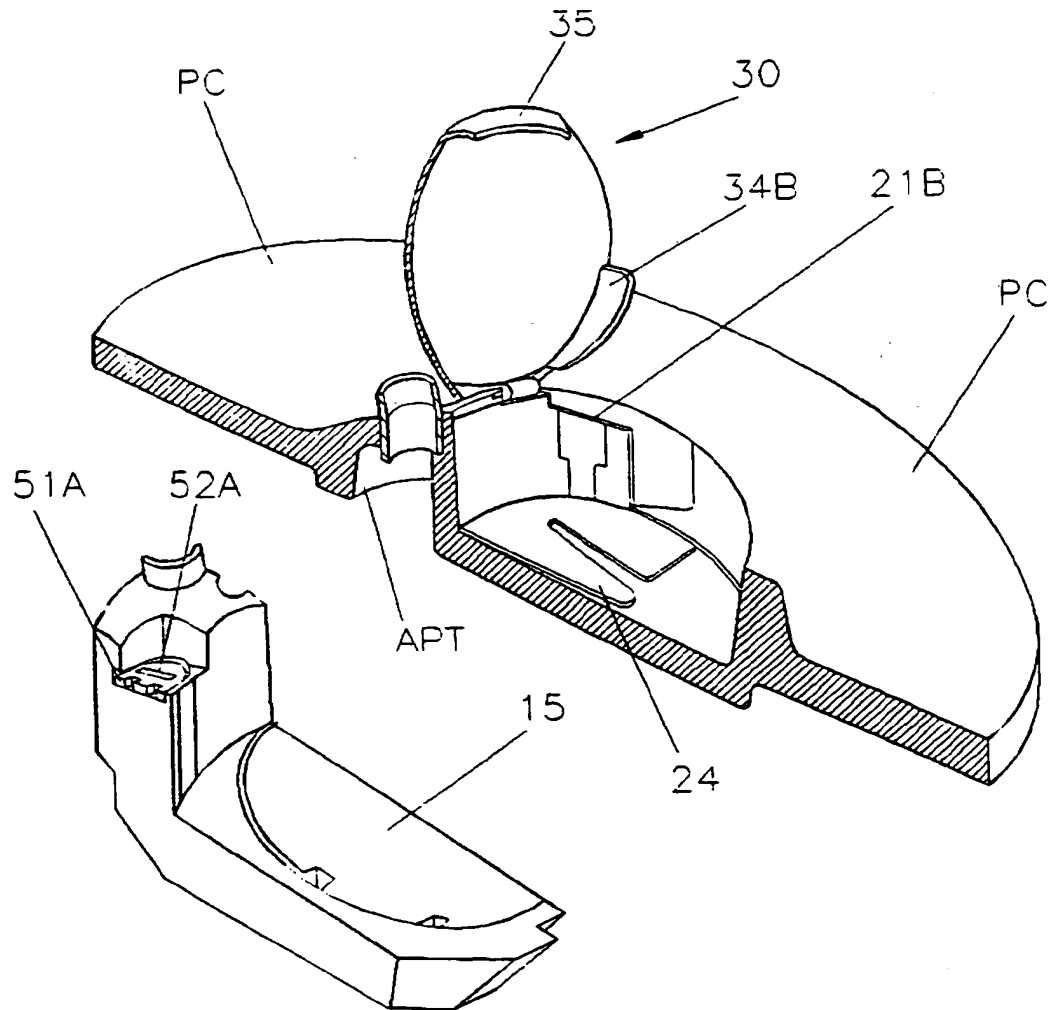
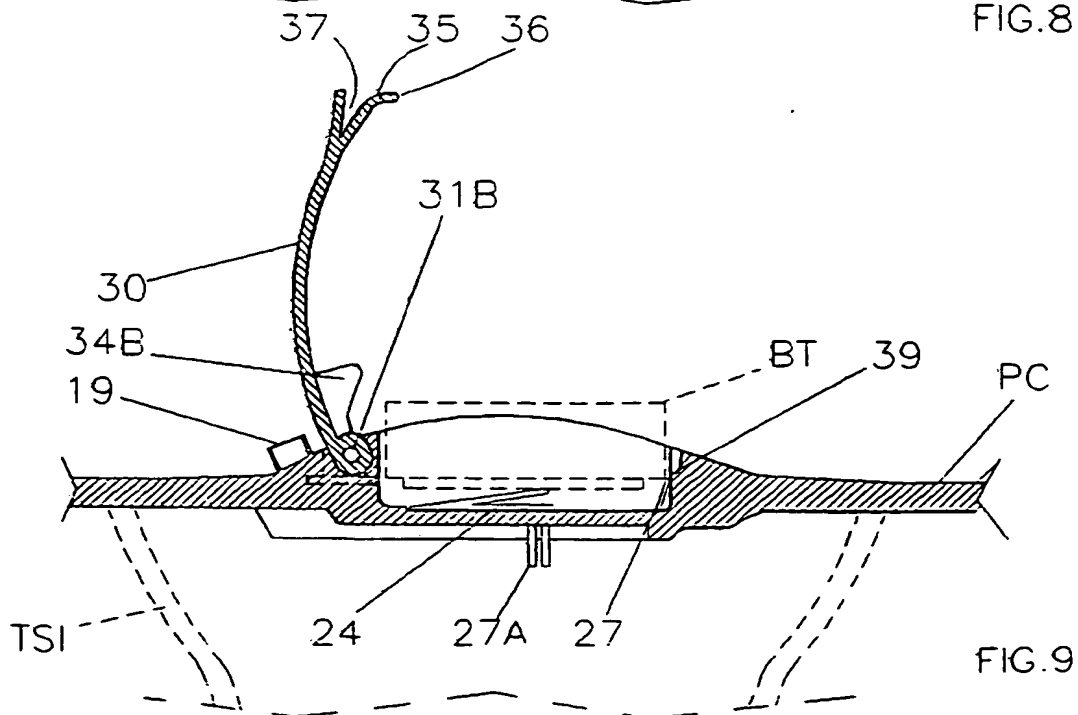
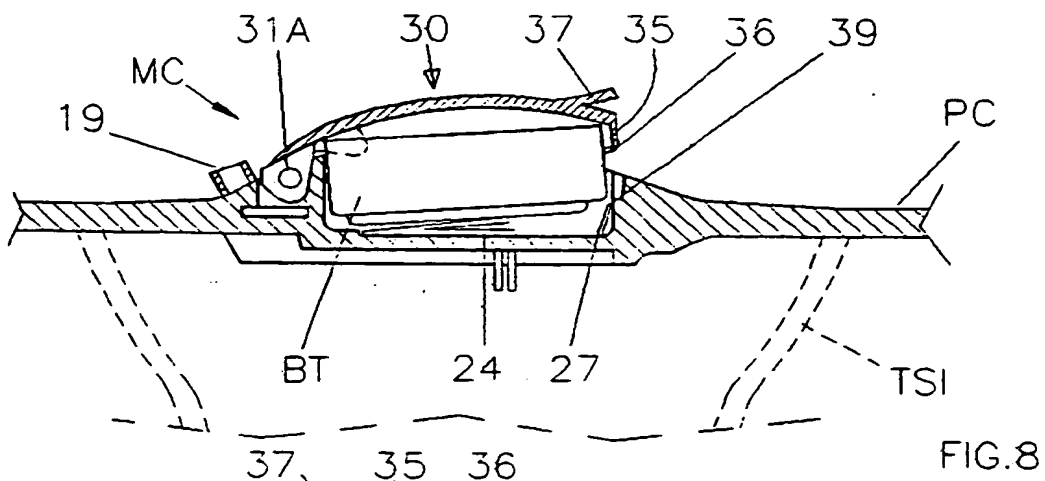
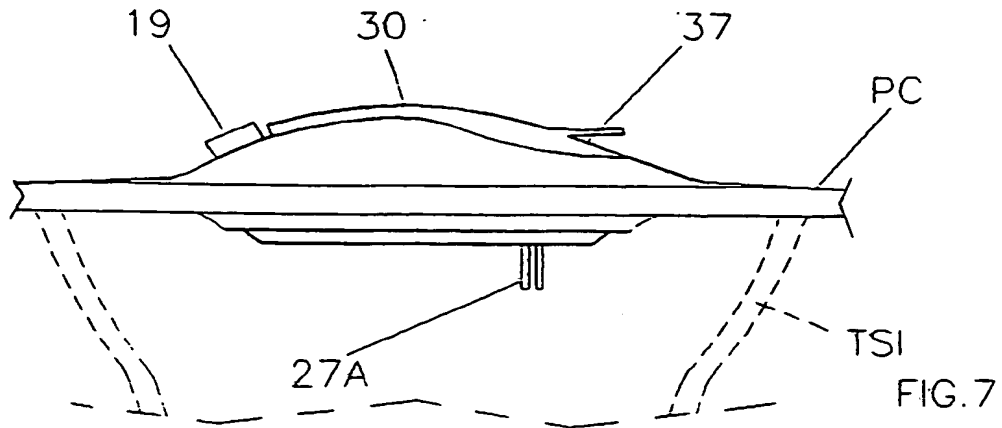


FIG. 6





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